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THE CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE

FIFTH in India's chain of eleven National Laboratories, planned by the Council of Scientific and Industrial Research, the Central Food Technological Research Institute was formally declared open on October 21st last by the Hon'ble Mr. C. Rajagopalachari. This Institute would deal with "all problems which require close and high-level scientific research" in the food field. It owes its genesis to the recommendation in 1945 of the Industrial Research Planning Committee of the Council of Scientific and Industrial Research that the highest priority should be given to the development of food technology. This recommendation was endorsed by the various food industries' panels set up by the Government of India and it was agreed that the Institute should be started under the auspices of the Council of Scientific and Industrial Research. The proposal was accepted in principle by the Governing Body of the Council in February 1948 and a beginning was made possible to put into effect the detailed plans that were soon worked out by the offer of the Mysore Government to place the Cheluvamba Mansions, Mysore, together with the attached

buildings, gardens, parks and grounds, covering an area of 150 acres, at the disposal of the Council for the location of the Institute. The Hon'ble the Prime Minister, as President of the Council, received the Mansions formally from the Mysore Government in December 1948 and the first laboratories started functioning by the end of July 1949 with other additions following steadily. Early in 1950, the Government of India rightly decided to merge the Institute of Fruit Technology with this Institute.

The various Divisions of activity of the Institute include: storage and preservation, processing, engineering, biochemistry and nutrition, information and statistics, quality control, and microbiology and sanitation; a Division of dietetics and a Section for food containers are also being organised. It would seem best to have a few of the more important Divisions working in full strength right from the commencement and expand the activities of the Institute as progress is made and as exigencies may demand.

There is undoubtedly great scope for development and research in food technology by way of improvement in methods of storage,

study of microbiological and biochemical changes attendant on various types of spoilage, reclamation and utilisation of infested or otherwise affected food materials, processing of foodstuffs with a view to improving their keeping and nutritional qualities, refrigeration, freezing, gas storage, dehydration, canning, and so forth. Much of the more elaborate procedures of preservation employed in foreign countries needs to be simplified to suit the needs of the country and especially during the current evolutionary phase of our economy. There is also much that could be accomplished by way of collaboration with Agricultural Departments and Nutrition Research Centres in the country. Indeed, the establishment of regional laboratories working in close association with the central laboratories and dealing in particular with local problems should soon be envisaged. In addition, the pursuit of knowledge for its own sake would, it is hoped, form a substantial part of the activities of the Institute; its scientific reputation will, in fact, be determined by the quality and output of the fundamental work done by it. Mr. Rajagopalachari stressed on this fact that much of the future of the Institute will admittedly depend on the quality of the men that will hold charge of its various activities and on their keenness in applying themselves as a team to the problems they will handle. "You should deal with trained men as you deal with other tools of work. There should be no favouritism in selecting a chisel or a razor. You should respect quality and aptitude and get along without favour or compromise."

In referring to some of the findings of the Institute like the so-called "synthetic rices" and "substitute milks", the Rajpramukh, the Maharaja of Mysore, who presided on the occasion, rightly observed that when substitutes for rice or for milk or for any other food are found, people at large are apt to be averse in utilising such products and that therefore it was incumbent on educated people "to expel such reluctance by betaking to such products themselves first and that openly. Conduct spreads by conduct and leadership in thought should be sustained by leadership in action, for social conduct flows like the purifying and fertilising Ganges from the heights to the plains below. The educated classes had thus an imperative obligation to see that their ways of life were conceived and directed by social objectives and values".

In a message for the occasion, Prime Minister Jawaharlal Nehru said that the National Laboratories in the country would be "the

homes of productive effort and work. It is ultimately on the basis of the work done in the research institutes and laboratories that we can progress in most directions. Thus far, we have depended on other countries and have merely copied them or taken advantage of something that they have done. We cannot go far with this dependence. We have at least laid good and true foundations for scientific progress. It is for the young scientists of India to take advantage of the great opportunities offered to them and thus help in building up the New India". He expressed the hope that "the work done in this Institute will bear fruit not in developments on paper and in scientific journals alone, but in terms of human values and in increase of suitable food for our people". Dr. Shanti Swarup Bhatnagar who has rightly earned a great name for his formidable drive and organising capacity and who has been the chief instrument in the rapid establishment of the different National Laboratories, expressed his confidence that *within a year's time* the Institute will make a "distinct contribution towards the solution of food shortage in India by its technological research". These hopes and assurances that have been voiced at this inauguration auger well for the future of this important Institution.

It may perhaps be contended that the inception and functional activities, under Government aegis, of the various National Laboratories would have a weaning effect on the other established research centres and University Laboratories, especially as recruitment to the senior posts of these national institutions has been mostly from these latter sources. Together with the necessary preparatory period before the National Laboratories can blossom into full activity, this circumstance, it may be viewed, might result in a temporary decrease in the scientific output of the country. Such an interpretation is probably baseless and, provided sufficient encouragement and funds are forthcoming, Universities should be able to hold their own in their different fields of research. Paying a tribute to the valuable work done by men of science in the country before the National Laboratories were conceived, Mr. Rajagopalachari observed: "This work was done under great difficulties and without the assistance of big laboratories such as we have now installed. In the Universities as well as in Scientific Academies outside Universities, very eminent sons of India have brought credit to our Motherland by their work. In modern days, however, scientific research has become highly organised,

The individual becomes a member of a team and his sphere of work is intensive though possibly restricted to a small subdivision of a section of the science in which he works. It is in this respect that we should congratulate our-

selves on the opening of the National Laboratories and Research Institutes during the last three years such as the one we have assembled to bless to-day".

NOBEL AWARD FOR PHYSICS

THE Nobel Prize for Physics for the year 1950 has been awarded to the British Nuclear Physicist, Prof. Cecil Frank Powell, for his distinguished work in developing the photographic technique of detecting nuclear particles. Powell is at present Professor of Physics at the University of Bristol, England. Last year, he was the recipient of the Hughes Medal of the Royal Society of London.

Powell's early researches were concerned with the properties of ion, which led him to an investigation of fundamental particles and atomic nuclei using photographic plates. In this method the particles are detected by the tracks which they leave in the photographic emulsion, which can be observed through a microscope after the plate is developed. Powell played a large part in bringing about a marked

improvement in the quality of sensitive materials and also in the development of methods whereby the energy, mass and other characteristics of the particles can be actually measured. Using these improved plates, Powell discovered a new elementary particle, the π -meson, whose mass is 280 times that of the electron and of which both positively and negatively charged varieties exist.

Powell was instrumental in establishing the photographic method as a standard technique in nuclear research. Together with G. P. S. Occhialini, he has published a book entitled *Nuclear Physics in Photographs*, which contains a description of the technique, and also a large number of photographs illustrating various types of nuclear reactions.

RADIOACTIVE CALENDARS

NUCLEAR physicists have found a new and accurate method of dating history by using radioactive materials to supplement the archaeologist's pick and shovel.

The pioneer is Prof. W. F. Libby of the University of Chicago, who has been experimenting with his colleagues in this field for several years. In 1947, he announced that C^{14} , up to then known only as the product of nuclear bombardment in atom smashing machines such as cyclotrons or atomic piles, is found in every living thing. In fact, there is more radioactive carbon to be found in human beings, animals and plants than physicists are ever likely to make by transmutation in the laboratory.

The atoms in the air are bombarded continuously by cosmic rays, and the nitrogen atoms in the air are transformed by the impact of cosmic radiation into radio-carbon (C^{14}). Now this radio-carbon has a "half-life" of 5,000 years. It is known that living plants absorb all forms of carbon through their intake of carbon dioxide. Animals eat these plants and in this way return the carbon dioxide to the air. The C^{14} absorbed by organisms during their lives is not renewed, but decays slowly after death.

As the radio-activity of a given weight of

carbon derived from organic matter 5,000 years old is half that derived from carbon in living material, it is possible to determine the age of an object merely by measuring its radio-activity. Thus, a wooden object 2,500 years old will have lost a fixed proportion of its radio-activity, while another object, only 1,000 years old, will have lost less and will produce more radiations.

In other words, all carbon of biological origin is in a slight degree radioactive. Because the earth is at least 2.5 thousand million years old, it is assumed its atmosphere must have reached a stage of radioactive equilibrium centuries ago. That is, C^{14} atoms are produced at a rate equal to their rate of decay. This decay is the result of a loss of a β -particle, and they can be detected by a sensitive Geiger counter.

This radio-carbon method of dating can be used to supplement dating by the tree-ring method. With trees dated by the direct method the radio-carbon method has shown good agreement. In other cases, the discrepancy has been great, and it has been suggested that it would be an interesting experiment to treat Prof. Libby's method as established and use it to check dates calculated from incomplete tree-ring data.—(UNESCO.)

CLASSICAL MECHANICS*

OF late the feeling has been steadily growing among several critics that the present-day importance of classical mechanics as an essential part of the curriculum for students of advanced physics is undeservedly overpraised. Inasmuch as it neither introduces any new physical concept nor leads the student directly into current physical research, the post-graduate student is likely to regard it as redundant. Its aid in solving his problems on practical mechanics which may arise in the course of his laboratory work is insignificant.

Closer scrutiny, however, reveals that in the first place classical mechanics serves as the spring-board for the various branches of modern physics. Observe, for instance, that the technique of action-angle variables is very much needed in the older quantum mechanics while the Hamilton-Jacobi equation and the principle of least action transport you smoothly into the realms of wave mechanics; a proper formulation of the newer quantum mechanics is rendered easier by the use of Poisson brackets and canonical transformations. It enables the student to equip himself with many of the mathematical techniques needed for quantum mechanics while still working in terms of the familiar concepts of classical physics.

To bring out these aspects sharply, it is obvious that there ought to be a thorough overhaul of the traditional method of presenting the subject. In developing his course of lectures delivered at the Harvard University into the present book, Prof. Goldstein appears to have kept this aim constantly in mind and has succeeded admirably. The accent has throughout been on those formulations which are deemed important from the standpoint of modern physics; increased elegance and compactness have been frequently achieved by the introduction of special techniques normally associated with quantum mechanics.

The discussion of motion under a central force has been broadened to include the kinematics of scattering and the classical solution of scattering problems. Canonical transformations, Poisson bracket formulations, Hamilton-Jacobi theory, and action-angle variables have all been discussed in detail. A somewhat brief introduction has been provided to the variational principle formulation of continuous systems and fields.

One example of the application of new mathematical techniques may be seen in the discussion of the rigid body rotations from the standpoint of matrix transformations. As a result, the familiar Euler's theorem on the motion of a rigid body may now be presented in terms of the eigen-value problem for an orthogonal matrix. Such diverse topics as the inertia tensor, Lorentz transformation in Minkowski space, and resonant frequencies for small oscillations all become now capable of a unified mathematical treatment. Another advantage claimed by the matrix methods is that 'spinors' can be introduced in connection with the properties of Cayley-Klein parameters.

Quite often in the past, special relativity has received no connected development except as part of a highly specialised course which also covers general relativity. On account of its vital importance in modern physics, Prof. Goldstein has considered it an advantage to the student if he is introduced to this topic at a fairly early stage.

While the development of classical mechanics historically has mostly been with the emphasis on static forces dependent on position only (such as gravitational forces) we have on the other hand, in modern physics especially, to deal frequently with velocity-dependent electromagnetic forces. Potentials dependent on velocity have therefore been incorporated in the structure of mechanics from the beginning and consistently developed throughout.

There is today a real dearth of a connected account of the classical foundations of the variational principle formulation of continuous systems, despite its growing importance in the field theory of elementary particles. The theory of fields can be developed considerably both in extent and complexity before one finds the necessity to introduce quantisation. An adequate discussion of topics such as the stress energy tensor, momentum space representations, etc., all entirely within the frontiers of classical physics would normally need a scholarship much beyond what could be expected of the average student using this book. Chapter 11 is therefore limited to an elementary description of the Lagrangian and Hamiltonian formulation of fields.

Prof. Goldstein's excellent book is useful both for the inadequately prepared student and the ambitious senior frequently desirous of omitting the intermediate step. While a certain amount of discipline in advanced calculus and the elements of vector analysis is assumed on

* *Classical Mechanics*. By Herbert Goldstein. Addison-Wesley Press, Inc., Cambridge 42, Mass. 1950. Pp. xi + 399. Price 6.50 dollars.

the part of the student, more complicated mathematical tools are developed as and when their need is felt. A proper understanding of the sections dealing with electromagnetic forces necessarily presupposes an acquaintance with Maxwell's field equations and the simple results flowing from them.

The exercises appended to each chapter are more in the nature of extensions of the main

text illustrating some special point or proving a variant theorem. At the end of each chapter we find references for elaboration of the material treated.

It is, altogether, an exhilarating experience to read through the book and find that classical mechanics is still going strong.

P. S. R.

BUILDING RESEARCH CONGRESS, 1951

A COMPREHENSIVE Congress on Building Research has been planned to take place in September 1951, in London and will be to review the progress made in research in relation to architecture, building and the associated branches of civil engineering, and it has been arranged because of the widespread interest shown in the subjects in many countries since the end of war. There have been rapid developments in all branches of building science and papers presented at the Congress will review these developments and will consider their significance and their effect on future trends. Many of the papers will be contributed by authors from overseas, and it is expected that the Congress will attract many members from all over the world from amongst the ranks of architects, engineers, builders and contractors and from many branches of Science.

For the purpose of the technical sessions, the Congress has been planned in three divisions holding concurrent meetings.

DIVISION 1, which is concerned with the engineering and structural aspects of building, will cover the influence of mechanisation and prefabrication on techniques and cost of building; the influence of modern research on structural design; and the influence of modern soil studies on the design and construction of foundations.

DIVISION 2, which is concerned with building

materials, will cover individual materials such as burnt clay products, cement and concrete, building stones, lime, paints, plaster and timber, and there will be in addition a wide survey of research on weathering and durability of building materials.

DIVISION 3 will be concerned generally with the various factors which influence the comfort and efficiency of the people using the buildings. The matters to be discussed include the acoustics of auditoria and broadcasting studies; the heating and ventilating of buildings in relation to summer and winter conditions; the lighting of buildings. In addition three specific types of buildings—hospitals, factories and schools—will be considered in the light of all the requirements they must meet if they are to fulfil their purpose.

Since the Congress has been arranged during the Festival of Britain, it is expected that hotel bookings in the London area will be very heavy and in their own interests members are advised to lose no time in reserving accommodation.

The centre of the Congress will be the Institution of Civil Engineers. For the time being arrangements are being handled from the Building Research Station, D.S.I.R., and enquiries should be addressed to Organising Secretary, Building Research Station, Bucknalls Lane, Garston, Nr. Watford, Herts, England.

BUILDING RESEARCH INSTITUTE

DR. J. N. MUKHERJEE, till recently Director, Indian Agriculture Research Institute, has been appointed Head of the Division of Chemistry and Director of the Building Research Institute, it is learnt.

Dr. Mukherjee has had a long career of research in soil sciences which have an intimate bearing on problems relating to building research. It is hoped that with his appointment

the Building Research Institute, which is one in the chain of national laboratories being established under the auspices of the Council of Scientific and Industrial Research, and where a good deal of work has already been done on "low-cost houses and soil stabilisation", will be able to expedite the research programme undertaken by the Council.

MORE ACCURATE FIGURE FOR THE VELOCITY OF LIGHT

IN the famous experiment conducted by Michelson in 1935, a value of 1,86,271 miles per second was obtained for the velocity of light. This figure was confirmed in other experiments and has been accepted ever since. However, an experiment recently completed at the National Physical Laboratory, England, by Dr. Essen has shown that the accepted figure has to be raised to the extent of eleven miles per second.

The method used by Dr. Essen is similar in principle to Michelson's but, whereas Michelson used a tube a mile long, Essen's tube measured only seven inches. A radio wave was sent down this metal tube and reflected backwards and forwards between the two ends. When the time of travel between the ends equals the time interval between successive waves, they build up

to produce an electrical resonance which can be detected with very high precision.

The velocity of light was not wanted accurately for any practical purpose until the advent of radar in World War II. In radar, the distance to an object is calculated from the time taken by a pulse of radio waves to travel there and back, the speed of the waves being the same as that of light. The new figure will, therefore, enable radar to be used more accurately. This will be particularly valuable for aerial survey work where the shape of the ground is plotted by means of radar.

The velocity of light also is used in calculating a great number of physical constants, but the most significant changes will probably be in astronomy, in atomic research, and in the field of radio.

ZIRCONIUM FOR FRACTIONAL WEIGHTS*

THERE have been many attempts in the recent past to substitute other metals for platinum in fractional weights. Sheet metal weights of tantalum have been found to be very good. The possible use of zirconium as a material for fractional weights has been dealt with in a recent article in the *Journal of the Franklin Institute*.

The considerations which made the authors use zirconium are that the metal is similar to tantalum in its properties, possesses a high melting point and involves a small buoyancy correction. Four fractional weights from 10 mg. to 50 mg. have been made and compared with a standard fiducial weight. The intercomparison of the zirconium weights has been done by

the Benoit scheme. The experimental results given can be taken to be "acceptably accurate", and more data will throw the final light on the subject.

It is not generally known that at least 0.02 per cent. of the earth's crust is composed of zirconium. Though the element appears to be more abundant than commoner metals like copper, zinc or lead, it is a very costly metal to isolate and hence is classified as a rare metal. It must be remembered in this connection that the beach sands of Travancore are one of the richest sources of zirconium. If attempts are made to produce the pure metal in quantity in India, there seems to be no reason why our country should not take a lead in the manufacture of zirconium fractional weights, apart from harnessing the metal to other uses.

N. R. SRINIVASAN.

*Thornton and Haber *Jour. Franklin Inst.*, 1950, 250, p. 39.

THE INDIAN ACADEMY OF SCIENCES

THE Sixteenth Session of the Indian Academy of Sciences will be held in Hyderabad from December 29 to 31, 1950, at the invitation of the Osmania University. Sir C. V. Raman, President of the Academy, will deliver the presidential address.

The programme includes the inauguration of the Session on 29th December, addresses by foreign scientists and reading of papers in Sections A and B. A symposium on "Recent Advances in the Technique of Plant Breeding", has also been arranged.

INDIAN SCIENCE CONGRESS, 1951

THE Indian Science Congress has been invited by the Governing Council of the Institute to hold its Thirty-eighth Session in the picturesque, serene and inspiring premises of the Indian Institute of Science, Bangalore. The Session will be inaugurated on the 2nd January next and continue its deliberations for a little more than a week until the 10th. The Pan-Indian Ocean Congress, which was conceived during the last Session of the Indian Science Congress, will also meet at Bangalore during the same period.

His Highness, the Rajpramukh of the enlightened and progressive State of Mysore, has graciously agreed to be the Patron of the Congress.

Prime Minister Jawaharlal Nehru is expected to address the plenary session. Prof. H. J. Bhabha, F.R.S., Director, The Tata Institute of Fundamental Research, Bombay, is the General President-elect of the Session.

A distinguishing feature of the Indian Science Congress during the last few years, has been the attendance of eminent visiting scientists from foreign countries. This year, the delegations of visitors who are expected to participate in the proceedings of the Session, are both large and particularly distinguished. Those attending the International Congress on Element-

ary Particles, scheduled to be held in Bombay in the middle of December, have all been invited to attend the Bangalore Session. These include Professors P. M. S. Blackett, J. D. Cockroft, N. Feather, W. Heitler, R. Peierls, C. F. Powell and L. Rosenfeld from Great Britain, Professors L. Leprince-Ringuet, F. Perrin and P. Auger from France, Prof. Niels Bohr from Denmark, Professors C. Möller and H. A. Kramers from the Netherlands, Prof. U. G. O. Amaldi from Italy, Prof. W. Pauli from Switzerland, Professors G. Wentzel, H. H. Staub, M. Schein and N. L. Bowen from the United States and Prof. M. S. Vallarta from Mexico. Among the other visiting scientists are Prof. A. D. Ross from Australia, Professors A. W. Mailvaganam and Baptiste from Ceylon, Professors R. A. Robinson and J. H. Strahen from Malaya and Professors A. Wald and R. Fieser from the United States.

It may be added that it is for the first time in the history of the Indian Science Congress, that a Research Institute—the Indian Institute of Science,—the premier Research Institute of India, has extended an invitation to the Congress. The credit of having taken this unusual and courageous step and establishing this new precedent, belongs to Prof. M. S. Thacker, Director, Indian Institute of Science, Bangalore.

FREEDOM FOR SCIENTISTS

THE real scientist is a creative artist. No one must boss him or drive him. Certainly arrange that his life be free from monetary worries; but let us remember that his life interest and pleasure is research. Leave him to carry on undisturbed by the stormy blasts and distractions of a quarrelsome world licking its wounds after a terrific fight. Do not let him be regimented by the politicians, even those of his own class. Then, the upward curve of research and discovery can continue unhampered, which it will never do if the spirit and vision of research are not free for advance. These will come through the exceptional man and he is often quite unappreciated by those of bureaucratic tendencies. There is an old Scottish pro-

verb, "Wha pays the piper, ca's the tune", and unless those who call the tune have a sympathy and understanding of the research instinct and the necessity for untrammelled development of its curiosity, the vast Government subsidies will be worse than wasted.

The present is indeed an age of stupendous advance, but granting the utmost to the creative genius of our time, we should never have run our mile, but for the furlong achieved by the pioneers of science in the last three generations. The past is important, the future is exciting, but the present interests us because we live in it.

—Courtesy of the *Journal of the Franklin Institute*,
October 1949, 248, No. 4, p. 354.

NUFFIELD FOUNDATION TRAVELLING FELLOWSHIPS FOR 1951-52

THE last date for receipt of applications for 31st March 1951 to 28th February, 1951.
the Fellowships has been changed from

K. VYASULU, Secretary.

LETTERS TO THE EDITOR

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A NOTE ON THE CRITICAL PRESSURE EFFECT IN COLLISIONS OF THE SECOND KIND IN MOLECULAR SPECTRA

TAWDE AND DESAI¹ observed selective enhancement of C_2 (Swan) bands in argon at a pressure of 15 mm. of the latter (Fig. 1). Later work in this laboratory using other rare gases indicates a similar behaviour, which may be tentatively explained as follows.

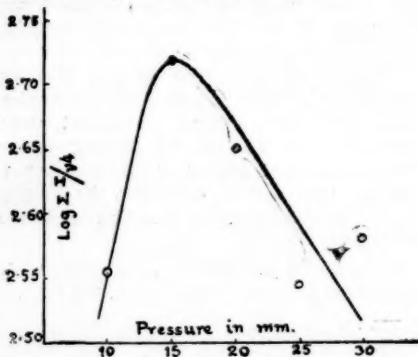


FIG. 1

We may assume, after Tawde and Desai, that collisions of the second kind are mostly responsible for the transfer of energy. In the present case, besides the ions and electrons (which

maintain the conductivity of the discharge) excited and unexcited argon atoms as well as carbon molecules are present in the discharge. The concentration of C_2 is negligible as compared to argon and the argon atoms thus take part in most of the collisions. In the positive column, the mean energy of the electrons is very low. Hence the chance of their exciting the argon atoms (11.5 volts) is small in comparison with the chance of exciting C_2 (2.5 volts). Most of these electrons being slow will make elastic collisions with argon atoms, but will have sufficient energy to excite C_2 molecules. Thus a large proportion of C_2 molecules will be excited by direct electron impacts and a small fraction by collisions of the second kind with excited argon atoms (metastable). The probability of the latter process is low as the energy levels of the two are further apart. In effect, the argon atoms play the role of increasing the path of the slow electrons by elastic collisions before getting lost at the walls or at the electrodes. As a consequence the probability of the electron meeting a carbon molecule and exciting it, is increased. The excited C_2 molecule deactivates by radiation or by collisions of the second kind.

With collisions increasing with pressure, more and more C_2 molecules get excited. Below 15 mm. the collision frequency is low enough for the time t between two successive

inelastic collisions to be relatively greater than the mean life-time τ of the excited state of C_2 . In this case after an activating collision occurs, there is little probability of further collisions occurring during the life time, and the molecule is left to deactivate by radiation. Hence the activation progressively increases with pressure until $(\tau - t)$ becomes zero in the close neighbourhood of 15 mm., at which t is equal to τ . Above 15 mm. t is less than τ and $(\tau - t)$ increases from zero to higher positive values. Here, after the molecule gets its first activating collision, chances of its making further collisions during the excited life time, increase. Thus there is a greater probability of its losing energy to a less energetic particle by collisions of the second kind before it radiates. This will bring about deactivation by inelastic collisions which increases progressively with pressure or with $(\tau - t)$ above 15 mm. The result will be progressive diminution in intensity of radiation. Thus we have a kind of critical effect at a pressure of 15 mm. of argon, at which it may be postulated that the time between two successive inelastic collisions is equal to the life time in the excited state. The life-time τ is considered to be invariable with pressure in molecular spectra according to Gaydon.²

Such a postulate is analogous to the Stern-Volmer³ condition for the quenching of resonance radiation and parallel to "close resonance" mechanism in collisions of the second kind in atomic spectra, supported by the experimental work of Beutler and Josephy⁴ and of Webb and Wang.⁵

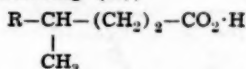
Spectroscopic Laboratories, N. R. TAWDE.
The Institute of Science, G. K. MEHTA.
Bombay,
October 4, 1950.

1. Tawde and Desai, *Proc. Ind. Acad. Sci.*, 1937, **6**, 266. 2. Gaydon, "Spectroscopy and Combustion Theory," Chapman & Hall, 1942, p. 106. 3. Stern and Volmer, *Physik Z.*, 1919, **20**, 183. 4. Beutler and Josephy, *Naturwiss.*, 1927, **15**, 540. 5. Webb and Wang, *Phys. Rev.*, 1929, **33**, 329.

4-PHENYL-PENTANOIC ACIDS. γ -ARYL- γ -METHYL-BUTYRIC ACIDS

IN connection with some other work in these laboratories, it was found necessary to prepare γ -aryl butyric acids. By adoption of Eijkmann's procedure by which γ -methyl butrolactone (I) was condensed with benzene and toluene in presence of aluminium chloride to corresponding γ -amyl butyric acids, it has been found

that (I) reacts readily with isomeric xylenes and other substituted aromatic compounds including tetraline to give excellent yields of the hitherto difficultly available compounds,^{1,2} as the following (II),



where R = 3 : 4-dimethyl phenyl (bp. 168-70/4 mm.); 3 : 5-dimethyl phenyl (bp. 170-1/4 mm.); 1 : 2-dimethyl phenyl (bp. 167-9/4 mm.); 1 : 2-dimethoxy phenyl (bp. 182-2/5 mm.); 3-methyl-6-methoxy-phenyl, (crystallised from benzene, mp. 91°-2°); 2-methyl-4-methoxy phenyl (bp. 183-5/5 mm.); 2 : 4-dimethoxy phenyl (bp. 190-2/5 mm.); crystallised from benzene, m. p. 72°-3°); 1 : 2 : 3 : 4-tetrahydro-7-naphthyl (bp. 192-5/4 mm.). By cyclisation of (II) with 80 per cent. sulphuric acid at 100° the following tetralones have been prepared: 4 : 6 : 7-trimethyl (bp. 150/4 mm.); 4 : 6 : 8-trimethyl (bp. 150-2/4 mm.); 4 : 5 : 7-trimethyl (bp. 146-8/4 mm.); 7-methoxy-4 : 6-dimethyl (bp. 157-/4 mm.); 7-methoxy-4 : 6-dimethyl (bp. 157-9/4 mm.) and 5-methoxy-4 : 8-dimethyl (bp. 156-8/4 mm.) tetralone and also 4-keto-1 : 2 : 3 : 4 : 5 : 6 : 7 : 8-octahydrophenanthrene (bp. 167-9/4 mm.).

The presence of γ -methyl substituent in (II) appears to facilitate the formation of hydro-naphthalene ring as it is found, that, while methyl- γ -(2 : 4 dimethyl) phenyl butyric acid readily undergoes ring closure, γ -(2 : 4) dimethyl phenyl butyric acid is refractive under the same standard conditions.

The authors are indebted to Prof. J. C. Bardhan for his keen interest during this investigation.

Org. Chem. Labs., K. C. BHATTACHARYYA.
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May 5, 1950.

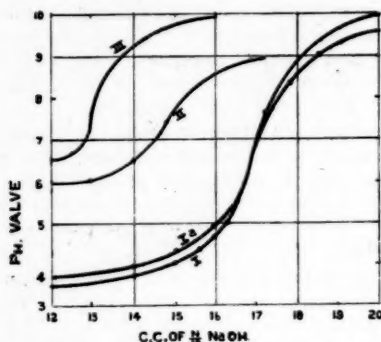
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ESTIMATION OF PARA-AMINO-SALICYLIC ACID

PARA-AMINO-SALICYLIC ACID, commonly known as PAS, has been found very efficacious in curing tuberculosis. An effort has been made to estimate it by the electrolytic titrations.

A roughly N/10 solution of para-amino-salicylic acid was prepared in a mixture of alcohol and water (1 : 4) and was titrated against

N/10 sodium hydroxide solution electrometrically. The curves obtained are given below.



- I. PAS from M/s. Hind Chemicals, Kanpur.
- II. PAS from M/s. P. J. Lobue Company, N.Y.
- III. PAS and Formal Dehyde.

Samples of PAS from two different sources were tried and all the curves give a very sharp point of inflection. On calculation the values obtained agree fairly with those given by the manufacturers.

The addition of formaldehyde to the solution gives a white precipitate, the sodium salt of which is soluble in water. The amount of alkali required to obtain point of inflection after the addition of formaldehyde is usually less than without formaldehyde. This behaviour is difficult to explain at this stage.

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Kanpur, U.P., S. N. KAPOOR.
September, 16, 1950.

ADSORPTION STUDIES ON METHANOL SYNTHESIS CATALYSTS.

I. Adsorption of Carbon Monoxide and Hydrogen on Zinc Oxide-Chromium Oxide Mixture

THE adsorption of hydrogen on zinc oxide and zinc oxide-chromium oxide catalysts has been investigated notably by Taylor and his co-workers. The adsorption of carbon monoxide on the mixed catalyst has, however, been left practically untouched, save for some comparative measurements by Taylor and Kistiakowsky.¹

The present communication concerns the adsorption of carbon monoxide as well as that of hydrogen on zinc oxide 75%-chromium oxide 25% (determined by a standard volumetric method) at close temperature intervals be-

tween 50° and 200° C. for carbon monoxide and upto 250° C. for hydrogen. The catalyst was prepared by precipitation from the solution of the mixed nitrates.

The results obtained show the occurrence of activated adsorption of carbon monoxide even at the lowest temperature studied, with an activation energy of 5 to 8.5 kcal. and a heat of about 6 kcal. for 0.9 c.c. adsn./g. The adsorption isobars of carbon monoxide at pressures below atmospheric show two maxima, one at about 52° and the other at about 178° C., thus revealing two distinct types of activated adsorption of this gas.

The results obtained with hydrogen compare favourably with those reported by Taylor and Strother² on a zinc chromite catalyst prepared from zinc nitrate and ammonium chromate. Activated adsorption has been observed even at the lowest temperature, the heat of adsorption being about 10 kcal. for 1.30 c.c. adsorption per gram and the energy of activation being about 8.5 kcal. for 1.19 c.c. adsorption per gram at 37 cm. pressure. In contrast with the observations of Taylor and Burwell³ it was found that the energy of activation decreased with increase of pressure, the values for 1.19 c.c. adsorption per gram at 47 cm. pressure being 4.7 kcal. The maximum adsorption of hydrogen was observed at 204° C.

The present catalyst was found to be more adsorptive than that of Taylor and Strother,² and, in contrast with the observations of Garner and Kingman,⁴ it adsorbed hydrogen rather more than carbon monoxide. Both hydrogen and carbon monoxide adsorptions increased steeply with pressure and showed no tendency to attain saturation as reported by Taylor and Kistiakowsky.¹

The surface area of the catalyst, as found by the Brunauer-Emmett-Teller method using argon at liquid air temperature, gave a value of 30.68 sq.m./g.

One of us (S.V.) is thankful to the National Institute of Sciences of India for the award of a Fellowship.

Gen. Chem. Section,
Indian Inst. of Science,
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October 30, 1950.

J. C. GHOSH.
M. V. C. SASTRI.
S. VEDARAMAN.

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ADSORPTION OF NITROGEN AT ELEVATED PRESSURES ON A PRO- MOTED IRON SYNTHETIC AMMONIA CATALYST

IN the synthesis of ammonia on iron catalysts, the formation of a "surface nitride", consisting essentially of chemisorbed nitrogen atoms, has been considered to be the important rate-determining step.¹ Although activated adsorption of nitrogen on various types of iron catalysts has been noted by many experimenters,^{2,3} a systematic study of the isotherms at a number of temperatures in the range of appreciable occurrence of the phenomenon has not been reported so far. Emmett and Brunauer² studied the adsorption of nitrogen on a doubly promoted iron catalyst at only two temperatures (400° and 450° C.), but the presence of chemisorbed hydrogen on the surface on which the nitrogen adsorption was determined, and the indirect technique employed by them in the high pressure measurements detract considerably from the reliability of their data. The present communication reports briefly the results of more accurate determinations of the adsorption isotherms of nitrogen on a Fe — K₂O—Al₂O₃—TiO₂ catalyst at seven temperatures between 50° and 350° C. and over the pressure range from 15 to 50 atmospheres, employing the direct volumetric technique developed by the present authors.⁴

While the adsorption at the lower pressures (20 and 30 atmospheres) exhibits only two maxima at about 150° and 300° C. respectively, at the highest pressure employed, viz., 50 atmospheres, three maxima are observed at 100°, 200° and 300° C. This indicates the occurrence of three types of activated adsorption on the same catalyst, corresponding probably to chemisorption on iron atoms in the three possible dispositions in the (111) plane.⁵

Since nitrogen might be expected to adsorb on the same iron atoms as hydrogen, the value of 0.4 c.c./g. for the maximum surface adsorption calculated in the case of hydrogen⁴ could be deemed to hold for the adsorption of nitrogen also. It has been found in the present investigation that the adsorption of nitrogen is for the most part below the surface saturation limit, thereby suggesting that absorption of nitrogen, as distinct from adsorption, is not considerable even at the highest pressure employed. This view receives further support from the fact that, at least upto 30 atmospheres, the volume adsorbed at several temperatures between 150° and 350° C. conform to the Brunauer, Love and Keenan equation⁶ which

has been based on the concepts of surface adsorption and desorption.

For an adsorption of 0.05 to 0.15 c.c./g. at 20 atmospheres, a value of 23 kcal. is obtained for the isobaric heat of adsorption. This value may reasonably be compared with that of 35 k.cals. obtained by Emmett and Brunauer² for their doubly promoted catalyst.

The authors are very thankful to Sir J. C. Ghosh and to Prof. B. Sanjiva Rao for their kind interest and encouragement.

Gen. Chem. Section, M. V. C. SASTRI
Ind. Inst. of Science, H. SRIKANT,
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October 30, 1950.

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EFFECT OF REDUCING AGENTS ON THE VIRUS OF NEWCASTLE (RANIKHET) DISEASE. 1. ASCORBIC ACID, 2. CYSTEINE HYDROCHLORIDE

THE fact that lemon juice exerts virucidal action on Rabies virus is well-known. The application of lemon juice in wounds produced by the bites of rabid dog has been reported to be efficacious in Ceylon. The precise information as to whether such effects are due to ascorbic acid or other acids contained in lemon is not clear. However, recent work on PR8 strain of influenza virus shows that ascorbic acid exerts virucidal action.¹ The toxic action of ascorbic acid on the virus is due to the formation of hydrogen peroxide when ascorbic acid is oxidised. When hydrogen peroxide is added in a concentration in which it is formed during the oxidation of ascorbic acid, the inimical action is found to be alike. This is accentuated by the addition of copper. KCN inhibits the action of ascorbic acid due perhaps to the formation of complexes with copper. Information regarding the effect of cysteine hydrochloride on viruses is not yet known.

Observations were carried out to determine the effect of ascorbic acid and cysteine hydrochloride on the Newcastle (Ranikhet) disease virus. Amniotic fluid of infected chick embryo was used and the viability of the treated virus was tested on susceptible chicks, 6-8 weeks in age.

Ascorbic acid was used in the concentration of 0.05 mg./c.c., 0.1 mg./c.c., 0.2 mg./c.c. in glass distilled water. The pH of the solution was adjusted between 7.4-7.6. Cysteine hydrochloride was also used in the above strengths. The procedure was to tube 9 c.c. quantities of either ascorbic acid or cysteine hydrochloride and subsequently add virulent Newcastle disease virus in order to make up a final dilution of 10^{-5} i.e., 100 M.L.D. contained in 0.5 c.c. The virus and the ascorbic acid/cysteine hydrochloride mixture was stored aerobically or anaerobically (in McIntosh and Fildes Jar) and kept at 5°, 15°, 32° and 37° C. for 24 hours. At the end of this period the mixture was injected in susceptible birds and the virus was found to be alive and still virulent.

Full details of this work will be published later.

Indian Vet. Res. Institute, K. C. SINHA.
Mukteswar—Kumaon, U.P., S. DATTA.
August 25, 1950.

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ANTIGENIC PROPERTY OF IRRADIATED NEWCASTLE (RANIKHET) DISEASE VIRUS

Good results have been reported in literature regarding the use of irradiated distemper virus (mink distemper) as a vaccine. Psittacosis virus, when exposed to ultraviolet rays, retains its antigenic structure intact and can be used to immunize mice.¹ These observations are interesting in view of the fact that wider application of physical agents may aid in the study of viruses better than hitherto done.

Trials were carried out at Mukteswar to see whether irradiated Newcastle disease (Ranikhet) virus of poultry can be used as a vaccine. Virus suspension was irradiated by alpine homesun lamp model VIII (Hanovia). No filters were used for this work.

The procedure consisted of using a 10^{-5} dilution in saline (0.85%) of the virus contained in the amniotic fluid of the chicken embryo. 1 c.c. quantities of this virus suspension were irradiated for 1-8 minutes at a distance of 36 inches from the object to the arc. The irradiated virus in the dose of 0.5 c.c. (100 M.L.D.) was inoculated into 6-8 weeks old chicks. It was found that the virus was fully alive even after irradiation for 6 minutes and such virus samples, when injected, killed chicks. After 7-8 minutes of irradiation, the virus failed to kill chicks. The immunity conferred by

this irradiated virus was tested. It was observed that the immunogenic property of the virus was lost during irradiation.

Fuller details will be published elsewhere.

Indian Vet. Res. Institute, K. C. SINHA.
Mukteswar—Kumaon, U.P., S. DATTA.
August 25, 1950.

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SOME RECOMMENDATIONS ON THE CONTROL OF TERMITES IN SUGAR- CANE

BASED on observations over a period of sixteen years, the following recommendations are made towards the control of termites, particularly during the period of germination in the hot weather. They have been successfully tested in the cultivators' fields:

Lime and Lead Arsenate.—2 oz. of lead arsenate is mixed with 20 oz. of lime in 30 lb. of water. The sets are planted after soaking them in this solution for 24 hours. This gives quick and good germination and it is specially beneficial in cases where planting has to be done in fields deficient in moisture or in cases of late plantings.

Phenyle.—One gallon of 'phenyle' is mixed with 50 gallons of water and then the sets are soaked in this solution for 24 hours before planting. It has been found to accelerate germination due to its stimulating effect and also affords considerable protection against termites.

Mercuric chloride-A 0.25% solution of this chemical has been found to give good germination besides preventing damage to eye buds and ends. 2 oz. of this powder is dissolved in 50 lb. of water to get the desired strength. The cane sets are dipped in the solution and planted when dry. Prolonged soaking is unnecessary.

D.D.T.—A 2.5% emulsion or suspension of D.D.T. has proved to be very effective in preventing the termite damage to eye buds and ends. The sets are planted after dipping them once in the solution.

Benzene-hexachloride.—A 5% dust of benzene-hexachloride (Gammexane D025) has been used with very good results. This powder is applied in furrows at the rate of 20 lb. to an acre before planting.

The effects of these treatments on the germination of eye buds, tillering and cane formation are always very encouraging particularly in plots treated with lime plus lead arsenate, phenyle or corrosive sublimate. An increase in yield from 9 per cent. to 19 per cent. has

also been recorded. The cost of treating the setts per acre is approximately Rs. 10 to Rs. 15 except corrosive sublimate, the application of which costs only Rs. 2-8-0 per acre.

Thanks are due to Dr. B. K. Mukherjee for his guidance and to I.C.A.R. and I.C.S.C. for financial assistance.

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August 5, 1950.

A NEW SPECIES OF ASCOCHYTA

DURING a routine plant collection tour round Simla, *Cyathula tomentosa* Moq. plants were found affected with a leaf-spot disease, due to an *Ascochyta* sp. No species of this genus has been reported so far on this host, or on closely related plants. The description of the fungus is, therefore, presented below. Being a new record, it is proposed to name the fungus as *Ascochyta cyathulae* sp. nov. Figure shows pycnidia and pycnospores.

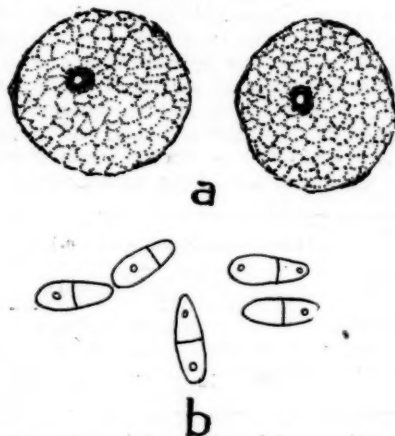


FIG. 1. *Ascochyta cyathulae*
(a) Pycnidia $\times 280$.
(b) Pycnospores $\times 1740$.

Ascochyta cyathulae sp. nov.

Spots light brownish, raised, circular, later coalescing; older spots with discoloured centres and brown margins, 8-15 mm. in diameter. Pycnidia epiphyllous, in discoloured spots, globose, smooth, 100-180 \times 90-150 μ , membranous, Buckthorn brown to Cinnamon brown (Ridgway), ostiolate, pore prominent, 15-21 \times 14-16 μ . Cells around the ostiole dark-brown in colour, pycnidial wall parenchymatous. Spores hyaline, oblong, 1-septate; septum distinct; both ends rounded usually; sometimes lower end acute; one or two oil globules pre-

sent; immature 1-celled spores 5-6 \times 2 μ , mature 2-celled spores 7-8 \times 3 μ .

On leaves of *Cyathula tomentosa* Moq., Flowerdale, Simla 13-xi-48 (R. L. Munjal). Type deposited in Herb. Crypt. Ind. Orient., Indian Agricultural Research Institute, New Delhi.

Maculae pallide brunneae, elevatae, circulares, postea coalescentes, vetustiores, maculae medio discolorato et marginibus brunneis, 8-15 mm. diam. Pycnidia epiphylla, in maculis discoloratis, globosa, laevia, 100-180 \times 90-150 μ , membranacea, Buckthorn brunnea and Cinnamomo brunnea (Ridgway), ostiolata, poro prominenti, 15-21 \times 14-16 μ . Cellulae circum ostiolum obscure brunneae, parietibus pycnidii parenchymaticis. Sporae hyalinae, oblongae, quarum una est septata, septo distincto, utroque apice rotundato vel nonnumquam inferiore apice acuto, presentibus uno vel duobus globulis olei; immaturis 1-cellulatis sporis 5-6 \times 2 μ , maturis vero 2-cellulatis sporis 7-8 \times 3 μ .

Habitat in foliis *Cyathulae tomentosae* Moq., in loco Flowerdale, Simla, 13-xi-48 (R. L. Munjal). Typus positus in Herb. Crypt. Ind. Orient., Indian Agricultural Research Institute, New Delhi.

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New Delhi,
July 31, 1950.

EARLY STAGES OF GROWTH OF WHEAT PLANTS AFTER VERNALISATION

THERE has scarcely been any serious attempt to study the growth of the plants at an early stage after vernalisation. A preliminary investigation was carried out in order to study the effect of vernalisation on the growth of wheat plants (*Triticum vulgare*, var. *Holdfast*), especially at the early stage. In connection with a work on bulk-vernalisation, a sample of the vernalised seeds of the 'Holdfast' wheat were sown in soil contained in rectangular wooden boxes. The boxes were kept in a temperature-controlled glasshouse. The vernalised seeds were sown in four rows having six plants in each row. Seeds, soaked for six hours in water at the room temperature and sown similarly, served as the 'control' set. It was found previously that the water content of the vernalised

seeds was the same as that of the unvernalsed ones when the latter were soaked in water for six hours at the room temperature. Bulk-vernalisation was done by exposing the soaked seeds for a period of twenty-one days to 0°C. within a constant-temperature cold-room at the Low Temperature Research Station at Cambridge. After sowing, regular observation and germination-count were made and the height of the plants were measured at two days' interval. The results are tabulated below and graphically represented in Fig. 1.

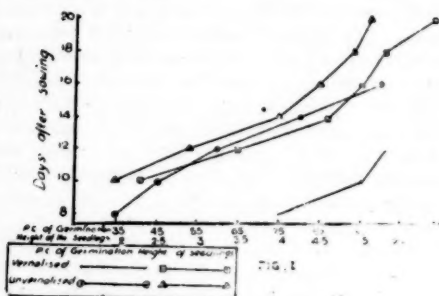


FIG. 1

The results indicate that the germination rate was distributed through several days in case of the unvernalsed seeds, but it was far too rapid in case of the vernalised ones. Cent per cent. germination was reached at by the

general observations and by splitting open the coleoptile lengthwise respectively. It was found that although the pattern of growth was similar in both the cases, there was a striking difference in the behaviour of the plants as regards their growing-points. In the seedlings developed from the vernalised seeds, the growing-points were elongated and pushed up much above the soil-level within a fortnight after sowing, whereas in those from the unvernalsed ones, they did not elongate, and remained at the soil-level.

Evans and Grover¹ (1940) noted that in grasses the growing-point elongated rapidly and that there was an increase in its diameter at the approach of the period of transition from the vegetative to the reproductive phase. They also referred to the importance of the length of day, among the various other environmental factors, in determining the time of initiation of the reproductive phase in the plants. As the plants, developed from the vernalised wheat seeds, flowered earlier than those from the unvernalsed ones, it is expected that the former would have the growing-point elongated much earlier than the latter. The conclusion reached at by the present author also corroborates this result, but the elongation of the growing-point in the 'Holdfast' wheat took place much earlier than was to be expected according to Evans and Grover (1940). The increased rate of growth and the elongation of the growing-point from

| | Percentage of germination | | | | | | Growth measurements (in cm.) | | | | | | | |
|-------------|---------------------------|----|----|-----|----|-----|------------------------------|-----------------------|-----|-----|-----|-----|-----|--|
| | Days after sowing | | | | | | Length of coleoptile | *Height of the plants | | | | | | |
| | | | | | | | | Days after sowing | | | | | | |
| Seeds | 8 | 10 | 12 | 14 | 16 | | | 10 | 12 | 14 | 16 | 18 | 20 | |
| Vernalised | .. | 75 | 95 | 100 | .. | .. | 1.42 | 2.3 | 3.5 | 4.6 | 5.0 | 5.3 | 5.9 | |
| Unvernalsed | .. | 35 | 45 | 60 | 80 | 100 | 1.02 | 2.0 | 2.9 | 4.0 | 4.5 | 4.9 | 5.1 | |

* Length from the soil-level upto the tip of the first green leaf.

vernalsed seeds within twelve days, whereas it took sixteen days for the unvernalsed seeds to reach that level. The length of the coleoptile as well as the height of the plants were greater in seedlings developed from the vernalised seeds than those from the unvernalsed ones at every stage of growth, the difference being almost similar at every stage, as can be seen from Fig. 1.

Observations were made on the pattern of growth and also on the growing-point of the seedlings by

the very outset and continued through every stage of growth and development, are perhaps, responsible for the early tillering and the initiation of the reproductive phase at an early date in case of the vernalised plants.

Division of Botany, D. K. MUKHERJI.
New Delhi, August 25, 1950.
Indian Agric. Res. Inst.,

1. Evans, M. W. and Grover, F. O., *Jour. Agric. Res.*, 1940, 61, 481-520.

THE DEVELOPMENT OF THE FEMALE GAMETOPHYTE IN *COUROUPITA GUIANENSIS* AUBL.

THE present account corroborates in all essential features Mauritzon's¹ observations on the ovule, integuments, nucellus and the integumentary jacket in *Couropita guianensis*. The points not recorded by Mauritzon are, the rare occurrence of two megaspore mother cells side by side in the same nucellus and the presence of 18 bivalent chromosomes during the first division of the MMC. In contrast to the findings of Mauritzon, the megaspore nuclei derived from the micropylar dyad cell are separated by a wall. The chalazal megaspore gives rise to an eight-nucleate embryo-sac. The synergids are characterised by pointed ends and basal vacuoles. The egg is comparatively smaller in size and occupies a central position below the synergids, while the primary endosperm nucleus lies close to it. The antipodals are small and degenerate very soon. The pollen grains have three germ pores and are binucleate at the time of shedding.

Department of Botany,
Calcutta University,
October 19, 1950.

I. BANERJEE.

1. Mauritzon, J., *Lunds Univ. Arsskr.*, N. F., Bd., 1939, 35 (2), 80-85.

HYGROMETRIC PROPERTIES OF SOME CAPILLARY SYSTEMS

HAIR hygrometers work on the principle that hair, on account of its capillary structure, absorbs moisture from the atmosphere and undergoes proportionate extension in length. To explore the possibility of extending this principle to the measurement of the vapour pressures of the common organic liquids, the hygrometric behaviour of a human hair and fibres of cotton, silk and nylon was studied in the vapour phases of different liquids.

The hair as well as the three fibres, 60 cm. in length, were mounted vertically in a glass tube and, to give a proper stretch, a sewing needle was attached, in each case, to the lower end, which was kept just below the opening of the tube. A stream of dried air was charged with vapour of a particular liquid and was then led over the fibres in the tube. The fibres showed gradual extensions in length and in about half an hour, acquired constant positions which was determined by means of a travelling microscope. The values of the extensions produced in the atmospheres of saturated

vapours of water and eight common organic liquids are given in Table I.

TABLE I

Extension of human hair and fibres of cotton, silk and nylon in atmospheres of saturated vapours of different liquids

Extensions in cm./100 cm.

| Liquid | Hair | Cotton fibre | Silk fibre | Nylon fibre |
|----------------|----------|--------------|------------|-------------|
| Water | .. 0.960 | 0.900 | 1.372 | 0.850 |
| Methyl alcohol | .. 0.282 | 0.400 | 0.221 | 1.366 |
| Ethyl alcohol | .. 0.288 | 0.420 | 0.122 | 1.266 |
| Butyl alcohol | .. 0.251 | 0.375 | 0.115 | 1.082 |
| Amyl alcohol | .. 0.222 | 0.370 | 0.102 | 0.975 |
| Acetone | .. 0.301 | 0.408 | 0.140 | 0.555 |
| Ether | .. 0.002 | 0.014 | 0.460 | 0.458 |
| Benzene | .. 0.024 | 0.036 | 0.550 | 1.201 |
| Xylene | .. 0.017 | 0.028 | 0.590 | 1.302 |

It is seen that hair does not undergo any appreciable extension in the vapours of ether, benzene and xylene. Of all the substances studied, nylon fibre is seen to be the best hygroscopic substance since its extension is largest in the case of all the organic liquids tried and is of the same order as the other fibres with water vapour.

To test its suitability for measuring vapour pressures of different liquids, its extension was determined in atmospheres of different vapour pressures of water, methyl alcohol, ethyl alcohol and ether. It was found that in the case of all the four liquids, the increase in length of the fibre, with corresponding increase in the vapour pressure of the atmosphere, is continuous, regular and appreciable. Nylon can, therefore, be used for measuring vapour pressures of water and the common organic liquids.

To determine the factors influencing the extension of a capillary system in a vapour phase, the amounts of the vapours of different liquids taken up by hair and nylon fibre were determined by placing known weights of these substances over different liquids contained in vacuum desiccators. The increase in weight was determined after about an hour when it had become constant. The results are given in Table II, where p is the percentage by weight absorbed of the vapour and e is the value of corresponding extension, reproduced from Table I. It is found that $\frac{e}{\gamma p}$ is nearly the same for all liquids, where γ is the surface tension. It appears, therefore, that besides the amount of the liquid absorbed, its surface tension also has an appreciable effect on the

TABLE II

Absorption of different liquids from vapour phase by hair and nylon fibre and their corresponding extensions

| Liquid | Hair | | | Nylon | | |
|----------------|----------------------------------|------------------------------|---|--|------------------------------|---|
| | Extension cm. (<i>e</i>) | % Absorption (<i>p</i>) | $\epsilon \times 10^5$ * <i>y. p</i> | Extension cm./100 cm. (<i>e</i>) | % Absorption (<i>p</i>) | $\epsilon \times 10^5$ * <i>y. p</i> |
| Water | .. 0.960 | 21.81 | 60 | 0.850 | 10.1 | 115 |
| Methyl alcohol | .. 0.282 | 21.60 | 57 | 1.366 | 48.6 | 122 |
| Ethyl alcohol | .. 0.288 | 11.39 | 60 | 1.266 | 46.8 | 120 |
| Butyl alcohol | .. 0.251 | 20.14 | 54 | 1.082 | 39.0 | 120 |
| Amyl alcohol | .. 0.222 | 18.41 | 55 | 0.975 | 37.4 | 118 |
| Acetone | .. 0.301 | 21.70 | 58 | 0.555 | 22.4 | 104 |
| Ether | .. 0.002 | 0.20 | 60 | 0.458 | 22.8 | 121 |
| Benzene | .. 0.024 | 1.6 | 52 | 1.201 | 39.1 | 106 |
| Xylene | .. 0.017 | 1.1 | 54 | 1.302 | 42.8 | 106 |

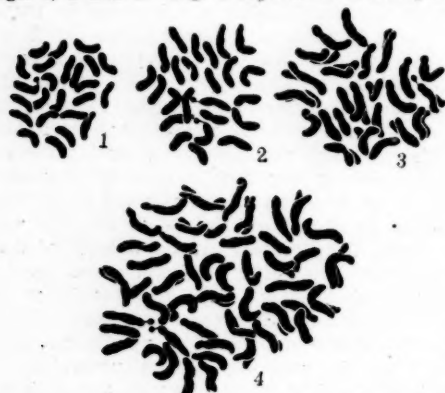
* *y* is surface tension of the liquid.

magnitude of the extension of a fibre—larger surface tension producing greater effect for a given weight of the liquid absorbed.

Dept. of Chemistry, BALWANT RAI PURI.
Panjab University, VIDYA BHUSHAN.
Hoshiarpur,
August-16, 1950.

ON THE SOMATIC CHROMOSOMES OF SOME NON-TUBEROUS SOLANUM SPECIES

THE somatic metaphase plates of three species *S. Seaforthianum*, *S. Warszewiczii* and *S. Verbascifolium*, are respectively illustrated in Figs. 1, 2 and 3. Fig. 4 represents a tetraploid



cell from *S. Verbascifolium*, a case of somatic duplication. The chromosome number of the first two species has been reported as being $2n = 24$ by Bhaduri (1933) and Tischler (1927) but the morphology of chromosomes has not been described before. The chromosome num-

ber of *S. Seaforthianum* also was found to be $2n = 24$ by the present writer.

When compared to the species of the tuberous group (Sinha, 1950), the chromosomes of the present species resemble in many respects. There can be seen in each one two pairs of chromosomes with a secondary constriction which although is not so clear in the case of *S. Seaforthianum*. The rest of the chromosomes have either a median, sub-median or sub-terminal constriction. In size and general morphology, the chromosomes of *S. Warszewiczii* and *S. Seaforthianum* (Figs. 2 and 1) resemble those of the diploid tuberous species, whereas the chromosomes of *S. verbascifolium* (Figs. 3 and 4) are much bigger and also somewhat different karyotypically. The position with regard to the number of satellites also appears to be similar in not being the same in the three species. One satellited-chromosome is to be seen each in *S. Seaforthianum* and *S. Verbascifolium* and two in *S. Warszewiczii*. The tetraploid cell shows two satellites borne on the same type of chromosomes as in the diploid species. In *S. Warszewiczii* and *S. Seaforthianum*, however, the satellites are borne on chromosomes with median and sub-median spindle-attachment respectively.

Dept. of Botany,
King's College,
University of Durham,
Newcastle-on-Tyne,
England, October, 1949.

N. P. SINHA.

1. Bhaduri, P. N., *J. Ind. Bot. Soc.*, 1933, 12, 56-64.
2. Tischler, G., *Tubulae Biologicae*, 1927, Band. 4, 43-44.
3. Sinha, N. P., *Ph.D. Thesis, Univ. Durham England* 1950, 105-07.

REVIEWS

A Concise History of Astronomy. By Peter Doig. (Chapman & Hall, London), 1950. Pp. xi + 320. Price 21 sh. net.

Astronomy has made considerable strides during the last fifty years, and a book briefly surveying the historical development, and summarising the present state of knowledge of the subject was in great need. As the author mentions, "No general history of the kind has appeared in English for forty years". The present volume will thus receive the welcome it deserves.

The first few chapters are devoted to a brief survey of early astronomical work. The work of the Newtonian period and of the 18th century, including the work of William Herschel is treated in some detail in four chapters. Three chapters are devoted to the astronomical discoveries of the 19th century, and refer not only to the facts discovered during the period, but also to the improvements in astronomical instruments and methods of observation. The astronomical facts in particular give a survey of planetary phenomena, measurements of solar and stellar parallax, and of cosmogony in general as known during the century. Four chapters deal with the progress in the 20th century, and present to the reader an up-to-date knowledge as regards the planetary system, and the structure and theories of the stellar universe. The chapters dealing with the work of the 19th and 20th centuries comprise evidently the most valuable portion of the book, and persons who are not specialists in astronomy will find here an authoritative and readable account of the progress and present state of knowledge of the subject.

But some of the author's views on the early history of astronomy are unfortunate, and will meet with serious criticism, at least from the scholars of the nations concerned. No history is worth anything if it is written by one who has not read the original sources in the languages of those nations, but comes to conclusions from the accounts written by others who were similarly ignorant of the originals and have often viewed matters with insufficient data and through coloured spectacles. The author happily remarks in one place, "It seems well to remark that the history of ancient science and even the general histories of early civilizations such as China, Egypt, . . . are in many respects not yet too well-founded. . . . In many instances,

scientific history is completely antiquated and at best enjoyable for its literary style". These remarks of the author must perforce be applicable to his own work. We give the following statements by the author, which concern India:

P. 41. "An Indian treatise on Astronomy (the author presumably refers to Brahmagupta's *Brahma Sphuta Siddhanta*) based largely on Greek knowledge was translated into Arabic and became a text-book for students."

P. 44. "The introduction of the decimal notation with a consequent enormous simplification of arithmetic was due to the Arabs."

Comments are unnecessary. It is enough to remark that articles and books on Indian Mathematics written in English by Indian scholars are available for the author's perusal.

C. N. S.

Weltsystem, Weltäther und die Relativitätstheorie. (World System, Ether and Relativity Theory). By Karl Jellinek. (Wepf & Co., Verlag, Basel), 1949. Pp. 445. Price Sw. Fr. 45-00.

This is a companion volume to the author's book on Wave Mechanics* and is likewise intended to be an introduction for experimenters. However, the book is sure to find a much wider use, since it contains a very logical and systematic development of both special and general relativity theories. It fills the gap that exists at present between the advanced treatises on the subject and various semi-popular accounts. While great stress is laid on the basic physical concepts, equal attention is paid to the mathematical development of those ideas. In order that the comparatively uninitiated may follow the book, more advanced portions are preceded by a development of the necessary mathematics; for instance, there is a chapter of twenty pages on tensor analysis.

Starting with introductory chapters on reference systems and the ether, the earlier part of the book is devoted to a thorough discussion of special relativity theory in relation to both mechanics and electrodynamics. Then follow an account of the general theory and the mathematical derivation of the three famous consequences of it, namely, precession of the perihelion of mercury, the curvature of a light

*Reviewed in *Curr. Sci.*, 1950, 19, 328.

ray in a gravitational field and the Einstein red shift. In the end, about a hundred pages are devoted to a description of the various relativistic cosmologies, including a short account of Milne's kinetic universe.

In certain respects, the treatment in the book is unorthodox. The author assumes that there exists a "world reference system, with respect to which all heavenly bodies, on the average, remain stationary" and that there is a "world-ether which, as a whole, is at rest in the world reference system". It is claimed that neither of these assumptions has been disproved and that the theory is more consistent when they are introduced. While it is true that they do not contradict any known facts, the reviewer does not find any particular advantage gained by their introduction, as the mathematical structure of the theory is unaltered. For instance, the equations of motion in the so-called "world reference system" is exactly the same as those in any other system in uniform motion relative to it and one does not see any justification in singling out that system alone.

In spite of this deviation from orthodox ideas, the book could be read with profit by anyone aspiring to have a good background of relativity theory.

G. N. RAMACHANDRAN.

Communication Circuit Fundamentals. By C. E. Smith. First Edition. (Published by McGraw Hill Book Co., Inc., New York, Toronto and London), 1949. Pp. x + 401. Price \$5.

This book is a very welcome addition to the available literature and represents the typical text-book that can go safely into the hands of a beginner. The treatment is everywhere very lucid, the use of advanced mathematics being avoided. It is, therefore, most useful to our diploma students in electrical engineering, who need to know the basic principles of communication circuits, etc.

The book is divided into twenty chapters. The first fourteen chapters are devoted to electricity and magnetism, a.c. and d.c. theory and series, and parallel circuits. This is followed by a chapter on network theorems. The last five chapters are devoted to thermionic emission, diode, triode, multi-element tubes and cathode ray tubes. The proportion of space devoted to tubes is very small and it is to be hoped that these chapters will be expanded considerably in a subsequent edition.

The printing and get-up of the book are excellent. On page 257, in figure 15.4 (a), Z_6 should really be Z_0 . This is really of no

significance, but it is important in books meant for beginners.

S. V. CHANDRASHEKHAR AIYA.

Physico-Chemical Constants of Pure Organic Compounds. By J. Timmermans. (Elsevier Publishing Co., Amsterdam), 1950. Pp. viii + 693. Price 95 sh.

As Director of the International Bureau of Physico-chemical Standards, which has been functioning for over twenty-five years, Prof. Timmermans is in a unique position for compiling this book. It is obvious that he has carried out his laborious task with the utmost care and with expert knowledge of the criteria of purity and the precision of the available data on the basis of which a few hundred organic compounds have been chosen from among the hundreds of thousands which have so far been synthesized or isolated from natural sources. In an earlier publication (*La Notion d'Espèce en Chimie*, Gauthier-Villars, Paris, 1928), Timmermans has described the precautions to be taken for a constant to "acquire the character of a real physico-chemical standard". The original reference for each constant is cited, and in an introduction to the bibliography the history of the investigation of the physical constants of pure organic compounds is traced. The ordinary organic chemist is content with determining the melting point of a compound within a degree or two, but schools of research on the properties of petroleum hydrocarbons, constants of pure gases, heats of combustion, and other physico-chemical properties of organic compounds have also been in existence. Some of the data cited in the book under review are those obtained by W. H. Perkin, Young and others in the last century—a remarkable tribute to the precision of their work. National laboratories, such as the Bureau of Standards at Washington, have now undertaken such work as a special responsibility, and the International Union of Pure and Applied Chemistry has set up permanent commissions for such studies.

The following are some examples of the criteria of purity. The boiling range must not exceed one-tenth of a degree. Samples are rejected if the saturated vapour pressure changes by more than 1/500th of its value from the beginning to the end of the isothermal liquefaction or vaporization. The freezing or melting point must be within a range of a tenth of a degree. The specific weight referred to its value in vacuo should be known to within 0.02%. Data are not recorded unless the paper from which they are taken contains sufficient

details of the method of determination to enable the precision to be judged. The constants are listed in the following order: constants of heterogeneous equilibria (b.p., saturated vapour pressure, critical temperature and pressure, freezing or melting point), constants in the vapour, liquid and crystalline states (specific weight, viscosity, surface tension, refractive index, dielectric constant, specific rotatory power, magnetic susceptibility), and finally heat constants.

There are a few printing errors, such as the density in the liquid state quoted at -136.5° while the freezing point is given as -129.7° (p. 33); specific heat quoted for the liquid state at -169.60° and -155.75° (p. 49) while the freezing point is 153.71° (p. 48); crystallizes (p. 139); iodine instead of iodide at the end of line 2, para. 3, in p. 210; $(\text{CHBr}_2)_2$ instead of $(\text{CHBr}_2)_2$ in p. 245; iso- used for *trans*- and not *cis*-crotonitrile (p. 543); Mersckx instead of Merckx (p. 650). For stearic acid the melting points cited range from 69.2 to 69.9° , but there is no indication of the constant to be chosen.

K. V.

The Chemistry of the Acetylenic Compounds.
Vol. II. *The Acetylenic Acids.* By A. W. Johnson. (Edward Arnold & Co., London), 1950. Pp. 328. Price £2-10-0.

Unlike the acetylenic hydrocarbons, the acetylenic alcohols, acids and their derivatives are safe to handle and comparatively easy to prepare. Because of their reactivity and their great utility for synthesis, the chemistry of the acetylenic compounds has attracted wide attention in recent years and Dr. Johnson's review of the subject is very valuable. Acetylenic compounds occur more frequently in nature than one might have anticipated from a consideration of the explosive character of the parent hydrocarbon. As stated in the Preface, nearly all the naturally occurring acetylenic compounds are acids or their derivatives. During the seventy years that have elapsed since Baeyer's first synthesis of indigo in 1881 from *o*-nitrophenylpropionic acid, there has been a slow realization of the importance of acetylenic compounds for the synthetic organic chemist, and it is only in the last decade, primarily as a result of the interest in the synthesis of vitamin A, that acetylene chemistry has been studied intensively. The main part of the present volume covers the literature up to the end of 1948, and the advances made in 1949 are summarized in an Appendix which cites 43 references.

The following misprints have been noticed: "nomenclature" broken up into two words on p. 2; $\text{HO}(\text{CH}_2)_n\text{NR}'_2$ printed as $\text{HO}(\text{CH})_{2n}\text{NR}'_2$ on p. 140; a missing letter in ref. 7 on p. 184; the formula of homoanthroxanic acid on p. 71. The formula of 2:2:3:3-tetrachlorohydrindone would look better with the single bond attached to Cl_2 omitted. The print is clear and pleasant to read, but different types of structural formulae have been used for no apparent reason (see for instance p. 75 and p. 114). Both dots and lines are used, sometimes in the same formula, to represent linkages between atoms and groups.

The book is clearly written; the classification and arrangement of the subject-matter are logical and convenient for purposes of reference, although the thoroughness with which the literature has been surveyed in a little more than 300 pages has led to some sacrifice of readability. Information on any aspect of the extensive series of compounds and reactions connected with the acetylenic acids and references to the original literature can be obtained very readily from the book. Each topic has been minutely subdivided; the table of contents runs into 20 pages and there are about 1,500 references. For advanced students and research workers in organic chemistry, Dr. Johnson's two volumes on acetylenic compounds, together with Reppe's *Acetylene Chemistry* and Copenhaver and Bigelow's *Acetylene and Carbon Monoxide Chemistry*, are essential books which must be available in the departmental library.

K. V.

Organic Chemistry. By Louis F. Fieser and Mary Fieser. (D. C. Heath & Co., Borton), 1950. Pp. xv + 1,125. Price 42 sh.

The well-merited reputation, which this book made immediately after it was first published in 1944, will be further enhanced by this new second edition in which much fresh material has been added. The presentation of the subject-matter is well-balanced, logical and to the point. The fundamental principles have been developed in 27 chapters, the remaining chapters being devoted to specialised aspects without any loss of continuity. Due attention has been given to the significant advances made during the last few years in fundamental organic chemistry, biochemistry, chemotherapy, technology, etc. Consideration has also been paid to the physico-chemical aspects of organic chemistry, including reaction-mechanism, electronic theory and resonance. The newly added

chapter on Heterocyclic Compounds, including alkaloids and flavone pigments, has added to the quality of the book. The chapters dealing with carbohydrates, proteins, microbiological processes, metabolism of essential food materials, quinones, polynuclear hydrocarbons, synthetic plastics and resins, dyes, steroids and accessory dietary factors are particularly illuminating. The book is an excellent introduction to organic chemistry and will be useful both for graduate and post-graduate workers and also for those who want to keep abreast with modern developments in this particular branch of science.

S. C. B.

Oils, Fats and Fatty Foods: Their Practical Examination. By K. A. Williams. Third Edition. (J. & A. Churchill, Ltd., London), 1950. Pp. xi + 500. Price 63 sh.

No introduction is needed to this well-known practical book, the last edition of which was published 22 years ago under the authorship of Bolton. While many of the fundamental methods of analysis have since remained unchanged, new methods have also come into use and various officially-sponsored bodies all over the world have had under review during this period a number of standards for oils and fats. Dr. Williams, who is President of the International Commission for the Study of Fats and has been member of various standardising committees in the fields of oils and fatty foods, has brought out a most authoritative account of analytical methods, carefully chosen to represent modern practice. There are notes on the interpretation of the results obtained that would enable the investigator to arrive at satisfactory conclusions. Descriptions of the by-products of the edible oil industry are included as well as of a number of poisonous and medicinal oils, the latter chiefly with a view to facilitating their recognition if admixed with or substituted for edible oils. Tables for analytical limits are given for well over 200 oils and fats which include some not described in the earlier editions. Certain sections such as those on milk products and vitamins have been extended.

The reviewer would have desired a more detailed reference to the use and examination of anti-oxidants. Photo-electric methods for colour measurement could have been brought up to date by inclusion of instrument models with compensating photo-cell devices. Likewise, in referring to the conversion factor for deducing vitamin A content from determination of extinction coefficient at 328 $m\mu$, attention could have been drawn to the factor derived for crys-

talline vitamin A acetate and accepted as official by the A.A.O.C. The treatments under vitamins D, E and K are inadequate even for a volume of this kind.

The book, on the whole, is very well produced; one or two misprints such as 'begin' for 'being' (p. 24) scarcely merit mention. It should recommend itself as heartily as its predecessor.

A. SREENIVASAN.

Melting and Solidification of Fats. By Alton E. Bailey. (Interscience Publishers, Inc., New York), 1950. Pp. vii + 357. Price \$7.00.

Fats and fatty acids have been a fruitful material for investigation on account of their many characteristic properties amongst which their melting and solidifying behaviour stand out prominently. A study of these and of the interrelationship between different phenomena associated with phase transformations have brought out much experimental data. Such a study, probably, started more than a hundred years ago, although more accurate work on carefully purified materials has been done during the last twenty to thirty years only.

The book under review has put together all available data on this subject from rather widely scattered sources. It is divided into five chapters. The first is devoted to general and theoretical considerations in which structure of fatty molecules, intermolecular forces, and structure, properties, formation and dissolution of crystals have been discussed. Laboratory techniques of thermal methods, dilatometric methods and of control methods for determination of the phase transformations of pure substances as well as of commercial fats are given in the second chapter. In chapters three and four are assembled data on the crystal structure, polymorphism, melting and solidification points and latent heats of fatty acids and glycerides singly and in binary and ternary systems and of commercial fats. Solubility data are presented in chapter five. Chapter six discusses the flow properties of fats, factors influencing consistency, melting characteristics of some commercial edible and inedible fats and fractional crystallization.

The material covered by Chapters 3, 4 and 5 has already appeared to a large extent in the two excellent volumes on Fatty Acids—one by Markley and the other by Ralston. To that extent, it might appear repetition. However, as remarked by the author in his Preface, "the text has been written primarily for the practising oil and fat chemist or technologist. . . and it is believed that portions may be of interest to physical chemists at large". Important

features of the book are the critical correlation and interpretation of data and suggestions for further work.

The few printing errors noticed are *mn* for *mB* (p. 67, 8th line from bottom), *L* missing in Fig. 67, page No. 221 instead of 211 and 'sold' for 'solid' (p. 277, 8th line from bottom). The two lines of para 2, p. 276 should be corrected to read, "According to Ku¹¹ eleostearic acid is considerably less soluble in 76% ethyl alcohol than oleic acid. . .". These are no doubt minor errors. It is to be noted also that *A* has been used as the abbreviation of Angström instead of the usual *A* (pp. 16-17).

The book should be highly useful to oil chemists as well as to physical chemists interested in the subject of phase transformations.

J. G. KANE.

Multi-Enzyme Systems. By Malcolm Dixon. (Cambridge University Press), 1949. Pp. 100. Price 7 sh. 6 d.

Multi-Enzyme Systems by Malcolm Dixon is based on the lectures delivered by the author at the University College, London, in May 1948. Although the subject appears to be an unusual one, there is no doubt that it has a special interest in modern Biochemistry and related fields because of the light which the study of Multi-enzyme systems are beginning to throw on living matter. After a lucid introduction on enzyme and their properties, Dr. Dixon describes how enzymes can be coupled together functionally and some of the processes which such systems can bring about. The free energy liberated by one enzyme reaction, usually an oxidation, is transferred to another enzyme reaction, usually a synthesis, which requires it. There is no doubt that this kind of processes are of fundamental importance for cellular activity. It is essential for the continuity of cellular activity that a particular type of mechanism should be present for trapping some of the free energy of reactions, for storing it and for transferring it so that it can be utilized to the advantage of other vital processes. Thus, the coupled enzyme systems carry out two kinds of reactions, viz., hydrogen-transfer reactions for generating energy and phosphate-transfer reactions for transferring and using it. In the last chapter the author describes the use of *rH* and *rP* scales for the evaluation of the energy data for these reactions. Although the author has presented lot of hitherto unpublished material, citation of the more relevant literature would have been a welcome addition to this interesting book.

P. R. VENKATARAMAN.

Wood Distillation and Its Products. By Baron A. Piret De Bihain & P. B. Padaki. Technical Monograph Series No. 1. (Technical Press Publications, Bombay). Price Re. 1.

The general principles of the process of wood distillation, including recovery of byproducts, have been briefly discussed in this 13-page monograph. The authors are associated with the wood distillation plant, installed at Londa in the Belgaum district of the Bombay Presidency. This plant, which is much smaller than the wood distillation plant at Bhadravati (Mysore), has a capacity to carbonize 80 tons of wood per day. In the bulletin a brief description of the carbonizing retort has been given, but no mention has been made of the scheme to be followed for recovery of the byproducts. The value of the bulletin would have been considerably enhanced, if the economic aspects of the wood distillation industry, particularly under Indian conditions, were discussed.

People interested in wood distillation will find a general review of the subject in this monograph.

S. K. N.

Lectures on Foundation Engineering. By A. E. Cumming. (*University of Illinois Bulletin*, Vol. 47, No. 35, Dec. 1949). Pp. 148. Price \$1.00.

The present Bulletin on foundation engineering is the outgrowth of lectures given by the author to his civil engineering students in 1941-42. The whole subject of foundation engineering has been explained in such a lucid manner that even persons with a very elementary knowledge of mechanics can easily understand the problems involved in the design of foundations. The treatment of the subjects of pile foundations and principal causes of settlement of structures are thorough. Every student aspiring to specialise in foundation engineering can with profit begin the study of the subject with this Bulletin.

It deals mainly with foundations for buildings.

Much water has flown since 1941-42. The proceedings of the Second International Conference on Soil Mechanics and Foundation Engineering and the recent books on the subject by Dr. Terzaghi, Casagrande and others give a measure of the rapid advance made since then in this comparatively new science. The theory of consolidation may be modified in the light of the present-day theories. The effect of earthquakes on foundations can also be mentioned briefly. In the design of foundations

mention has been made only of live and dead loads. In addition, shock loads or those causing vibrations in structures, especially those near the railway lines, will have to be taken into account. This is also necessary in case of important buildings which have to be proof against concussions caused by the falling of bombs. In certain situations, foundations will have to be designed not only to resist the weight of the superstructure but may also have to act as a retaining wall to resist earth pressures from sides. The design of such retaining walls which form part of foundation work has to be described briefly. On page 59, a mention has been made that piles are needed merely to compact a bed of loose sand so as to give it a greater density and a higher bearing capacity. The method by which this is done, specially by the method of enclosing the area by sheet piling all round, has to be described. This may render the use of batter piles unnecessary in many situations. The practice of driving holes close apart in loose soils and filling them up with sand to consolidate the soil in the case of light structures may also be mentioned. Description of the apparatus and the tests now made in soil mechanics laboratories for determining bearing capacity, settlement, shear and cohesive strengths, etc., can usefully form the subject-matter of another chapter.

The book is well got up with a number of photos and illustrations.

N. S. GOVINDA RAO.

Symposia of the Society for Experimental Biology. Number IV. Physiological Mechanisms in Animal Behaviour. Edited by J. F. Danielli and R. Brown. (Cambridge University Press), 1950. Pp. 482. Price 35 sh. net.

This number contains the papers read at a Symposium of the Society of Experimental Biology held at Cambridge in July 1949. In recent years almost every branch of physiology and biology has seen considerable expansion. The volume of scientific publications has increased to such an extent that even the specialist in limited fields, finds it difficult to cope up with the rapid developments in his own subject. The publication at frequent intervals of specialist surveys, such as those provided by the above symposium is, therefore, welcome. The twenty-one articles in this volume are authoritative and masterly contributions by well-known experts in their respective branches. The contributions cover advances in both experimental and theoretical fields.

The book has four sections. The first deals

with the range of capabilities of the sense organs of hearing, vision, proprioceptors, labyrinth and equilibrium. The second section deals with the central and peripheral control of behaviour patterns, the third with instincts, taxes, etc., and the fourth with learning. The book is a blend of physiology and psychology. Every psychological process has a physiological correlate and demands a physiological and psychological explanation. There is an interesting discussion on the dispute between vitalistic and mechanistic schools of behaviour study. Perhaps the United Nations may take note of the scientific approach to control the necessary outlets for certain endogenously generated drives, for instance aggression, and some knowledge of human innate releasing mechanisms, especially those activating aggression.

INDERJIT SINGH.

Wild Animals in Britain. By O. G. Pike. (Macmillan & Co., London), 1950. Pp. xii + 231. Price 18 sh.

It is rather unfortunate that man is not only distrusted by his own kin, but also by animals! *Per contra*, if a haven is created where the animals are left unmolested, either for reasons of sport or otherwise, the animals look up to him as a friend. Sanctuaries are, therefore, of national importance if we are to preserve our wild-life. Dr. Pike tells us that in his own garden sanctuary of two acres, he has induced mammals and birds to come and take food from his hands. There is a general feeling that animals in the protected areas multiply enormously and soon become a pest, but the fact is Nature always creeps in and restores the balance. Voles multiplied in great numbers in Scotland only when man had killed all the birds of prey and the waeel which happened to be their checkmate.

In the book under notice, Dr. Pike has described the natural history of the British mammals, reptiles and amphibians. The descriptions are accurate and enlivened by anecdotes and references to classics. There are also a number of coloured plates and original photographs. An anecdote is worth quoting: when the author told some members of a hunt party of the cruelty in giving over to the hounds a fox that had hid in a chimney, he was told that the fox really enjoyed it! The climax came soon after when two innocent labourers were fined £10, because their dogs had chased and killed a rabbit before the dogs could be called back.

It would be interesting to find out what exactly the anal gland of the omnivorous badger secretes which is sucked by other badgers. The

pole cats emit a nauseating odour from their anal gland only if frightened, but the author tells us that if they are kept clean, the nauseating smell usually associated with them becomes a fallacy. Still enigmatic is the way in which a dormouse by making a tiny hole in a nut clears the contents of it.

There are two indexes and the get-up of the book is excellent. However, I noticed one error in the shape of an additional punctuation mark in the penultimate line of the last but one para on page 212.

The book is so full of information that it is recommended to every student of natural history. May the reviewer express the hope that an equally authentic and comprehensive book as this will soon be compiled about Indian mammals, if not about all the vertebrates?

L. S. R.

Botany—A Text Book for Colleges. By J. B. Hill, L. O. Overholts and H. W. Popp. Second Edition. (McGraw Hill Book Co., N.Y. & London), 1950. Pp. xvi + 710. 335 Figs. Price \$5.27.

The contents of this delightful book comprise of materials intended for a two semester college course. The first part dealing with the structure and physiology of seed plants begins with a general introduction followed by a chapter on plant pigments, a striking feature of plants usually neglected in text-books. In the other ten chapters treatment of the subject does not differ much from the general plan followed in majority of text-books. Separate chapters have been given to seeds and seedlings, metabolism—food synthesis; growth and movement; metabolism—catabolic phase—digestion, respiration, fermentation. The second part, in six chapters, deals with plant groups, classification, nomenclature and families of angiosperms. Bacteria, slime, molds and fungi are grouped under thallophyta. A chapter on heredity is added at the end.

Many items of practical interest not usually found in general text-books of botany are briefly included. For example, accounts of viability, longevity and dormancy of seeds; factors affecting growth (heredity, nutritional balance, growth substances, vitamins, hormones, correlation of plant parts, grand period of growth); viruses, economic importance of fungi—penicillin and its uses; medical mycology; plant diseases, plant pathology and control are found. A newer system of classification (based on Prof. Tippo) has been given and for comparison the older system is presented on the opposite face.

The presentation is nondogmatic, simple and clear; yet as a previous reviewer has stated, this book is no child's play. The book would be welcomed by all students and should find a place in every teaching college.

N. K. S.

Wheat in a Victorian Bulk Depot. Bull No. 244. C.S.I.R.O. Australia, 1949.

This Bulletin is an interesting and accurate record of changes occurring in a very large mass of bulked wheat stored over nearly three years. Usually, this type of work is attempted with comparatively small lots of grains, the inferences drawn from such observations being applied, *ipso facto*, to bulk quantities, without much justification. Here, the author has made effective use of the unique opportunity afforded to him of working on probably one of the world's biggest single heaps of wheat occupying 1,72,260 sq. feet of floor space and holding more than 90,000 tons! Into this prodigious mass he has dug and delved, with meticulous care and precision, making observations about changes in temperature, moisture content, insect-infection, loss of weight and other relevant data at definite sampling-points and at regular intervals, from the time the mound was built up, till it was all moved out,—which was nearly three years. The author deserves to be complimented on this compilation, in which he has presented the results of three years' untiring labours which act as a guide to workers outside Australia.

The terse description of Marmalake No. 1 depot (pp. 7-8) might, however, have been accompanied by a sketch to help the readers in other countries understand the "arrangements" better. Moisture content determinations stated to have been made after a considerable interval after taking the samples (p. 20) are admittedly defective as stated by the author himself (p. 22) though this is greatly mitigated by probably treating all samples alike in this regard. The section on "Insect infestation" is slightly confusing even to the careful reader, and the figures do not really help to dispel this confusion.

These minor defects notwithstanding, this monograph is a valuable contribution to the literature on grain-storage. Especially in our country where a shortage of foodgrains to meet current requirements is causing anxiety, the observations recorded in this Bulletin will be very useful in planning for safe storage of large reserve stocks of grains, proposals for which are being considered by Government.

D. SESHAGIRI RAO.

SCIENCE NOTES AND NEWS

Plasticine as Embedding Material for Making Free-hand Sections

Sri. P. J. Dubash, Botany Department, Royal Institute of Science, Bombay, writes as follows:

It has been the practice so far to embed leaf material in pith, pieces of carrots, etc., prior to taking free-hand sections. This method, though universally adopted, has the following drawbacks: (1) The material keeps moving inside the pith with every stroke of the razor; this results in oblique sections. (2) The pith in itself is hard to section and more often than not, it is harder than the material to be sectioned. (3) It thus becomes very difficult to obtain sections, particularly, preserved material which is generally very so.

It has been my experience that by embedding the sectioning matter in plasticine all these disadvantages are obviated. Not only that but it is possible to obtain very thin sections. The shavings of plasticine could then be collected and used again *ad infinitum*.

This method, it is hoped, will be of some use both to the undergraduates and the research students alike.

Child Welfare Films

The "International Index of Films and Filmstrips on Health and Welfare of Children", contains some 1,000 titles from 26 different countries. It includes films made for the general public, health education shorts for children themselves, and medical and other technical films for professional personnel. For each film, information is included concerning the content, length, and approximate date of production as well as the full address of the distribution source or producer.

All films are listed in the catalogue under their countries of origin, and indexed by subject classifications. The subject index includes sections on growth and development, nursery schools, child psychology, diseases and their control, education, holidays, safety, maladjusted children, welfare, nursing, medical and scientific subjects, nutrition and public health.

The films have not been evaluated by either UNESCO or WHO, but it is hoped that the information given is full enough to indicate the relative value and usefulness of the various films.

—By courtesy of "WHO Newsletter".

IXth International Congress of Entomology
The IXth International Congress of Entomology

will be held between August 17th to 24th, 1951, in Amsterdam (Netherlands). Entomologists wishing to receive in due course programmes and application forms are requested to communicate even now with the Secretariat, C/o Physiologisch Laboratorium, 136 Rapenburgerstraat, Amsterdam.

Further communications will follow soon.

Seventh International Botanical Congress—

The Seventh International Botanical Congress met in Stockholm, July 12-20th, 1950, under the presidency of Prof. C. Skottsberg, Director, Emeritus, of the Göteborg Botanical Garden. Nearly fourteen hundred plant scientists from all corners of the world, attended the Congress.

There were 15 special sessions: (1) Economic Botany; (2) Cytology; (3) Experimental Ecology; (4) Experimental Taxonomy; (5) Forest Botany; (6) Genetics; (7) Morphology and Anatomy; (8) Mycology and Bacteriology; (9) Nomenclature; (10) Palaeobotany; (11) Phytogeography (with Comparative Ecology); (12) Phytopathology; (13) Plant Physiology; (14) Taxonomy of Cryptogams; (15) Taxonomy of Phanerogams.

Mention should be made of the Palynological Conference in Bromma, organized by G. Erdtman, the meetings which led to the establishment of an International Association for Plant Taxonomy and Geography (Sec.: J. Lanjouw), a round table conference on urgent needs in cryptogamic botany, the special sessions arranged for, at the last moment, in order to give the Russian delegates an opportunity to present their scientific (and political) views, and the meetings of the International Union of Biological Sciences prior to the Congress in the building of the Swedish Academy of Sciences.

I.C.A.R. Aid to Current Science

We wish to tender grateful thanks to the Indian Council of Agricultural Research for the generous subvention of Rs. 500 for 1949-50 towards the publication cost of *Current Science*. This annual grant which *Current Science* has been receiving since 1940 has contributed substantially towards the maintenance of the Journal.

EDITOR.

Vol. 19, No. 10, page 309, column 2: Note on "Suppression of High Frequencies in the Production of Joshi Effect"; delete line 3 from the bottom.